

**WE CLAIM:**

1. A method for measuring the concentration of at least one of at least one gaseous component and at least one vaporous component of a gaseous mixture comprising the steps of:

introducing a controlled sensor flame into said gaseous mixture;

optically measuring at least one narrow spectral band at least one of in and around said controlled sensor flame; and

calculating a concentration of said at least one of said at least one gaseous component and said at least one vaporous component using a result obtained from said optical measuring of said at least one narrow spectral band.

2. A method in accordance with Claim 1, wherein said controlled sensor flame is introduced into flue gases from an industrial combustion process.

3. A method on accordance with Claim 1, wherein said concentration of said at least one of said at least one gaseous component and said at least one vaporous component is determined using an intensity of spectral radiation in said at least one narrow spectral band.

4. A method in accordance with Claim 1, wherein said controlled sensor flame is fueled by at least one hydrocarbon fuel.

5. A method in accordance with Claim 1, wherein said at least one gaseous component is O<sub>2</sub>.

6. A method in accordance with Claim 5, wherein said concentration of said O<sub>2</sub> is used for substantially real-time control of a combustion process.

7. A method in accordance with Claim 1, wherein said controlled sensor flame is a co-flow diffusion flame.

8. A method in accordance with Claim 1, wherein said controlled sensor flame is an opposed diffusion flame.

9. A method in accordance with Claim 1, wherein said controlled sensor flame is a premixed flame.

10. A method in accordance with Claim 1, wherein said controlled sensor flame is a partially premixed flame.

11. A method in accordance with Claim 1, wherein oxidant for said controlled sensor flame is provided by said gaseous mixture.

12. A method in accordance with Claim 1, wherein said gaseous mixture comprises at least one of moisture and particulates.

13. An apparatus comprising:

a combustion chamber having means for introducing a fuel and oxidant into said combustion chamber and an exhaust conduit suitable for conveying products of combustion from said combustion chamber in fluid communication with said combustion chamber;

control means for controlling a flow of said fuel and oxidant into said combustion chamber;

a controlled sensor flame disposed in said exhaust conduit;

an optical sensor adapted to measure at least one narrow spectral band at least one of in and around said controlled sensor flame, said optical sensor having a signal output; and

signal processing means for converting a signal generated by said optical sensor to a gas concentration of at least one of a gas and a vapor disposed in said products of combustion operably connected to said signal output.

14. An apparatus in accordance with Claim 13, wherein said signal processing means is operably connected to said control means and controls said flow of fuel and oxidant into said combustion chamber based upon said signal generated

by said optical sensor.

15. An apparatus in accordance with Claim 13 further comprising a flame shape sensor adapted to determine at least one dimension of said controlled sensor flame operably connected to said signal processing means.

16. An apparatus in accordance with Claim 13 further comprising temperature means for measuring a temperature of said products of combustion proximate said controlled sensor flame operably connected to said signal processing means.